Transportation Safety Board of Canada
Bureau de la sécurité des transports du Canada

Canada

AVIATION REPORTS - 1994 - A94W0037

The Transportation Safety Board of Canada (TSB) investigated this occurrence for the purpose of advancing transportation safety. It is not the function of the Board to assign fault or determine civil or criminal liability.

Engine Failure
Hard Landing
Turbowest Helicopters Limited
Aerospatiale AS350B Astar (Helicopter) C-FHBG
High Prairie, Alberta 62 nm NE
04 April 1994

Report Number A94W0037

Synopsis

The pilot was transporting a patient to a ground vehicle that was waiting to transfer the patient to the High Prairie Hospital. While the helicopter was circling to land, the engine suddenly lost all power, and the pilot carried out an autorotation. The helicopter touched down heavily, collapsed the skid gear, then rolled onto its left side. The helicopter was substantially damaged; however, the three occupants were not injured.

The Board determined that the floor-mounted fuel flow control lever was inadvertently moved to the closed position, resulting in fuel starvation to the engine, a total loss of engine power, and low rotor rpm.

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1.0 Factual Information

1.1 History of the Flight

On 04 April 1994, the pilot was flying an Aerospatiale AS350B helicopter, C-FHBG, operated by Turbowest Helicopters Limited, and was transporting a patient on a stretcher from a rural seismic site to a ground vehicle so that the patient could be transferred to the High Prairie Hospital. The helicopter engineer was also on board.

The pilot was circling over a road to determine if it was free of vehicular traffic for his landing. While at about 150 feet above ground level (agl),1 at an airspeed of about 70 knots, the pilot experienced and corrected for a yaw. At this time the low rotor rpm warning sounded. He determined that the engine (Turbomeca Arriel 1B) had lost all power. An autorotation was carried out into the only available clearing in a wooded area.

Shortly before the low rotor rpm warning sounded, the patient on board was attempting to adjust a knapsack that had been placed under his dislocated right knee to help relieve the pain. The ...

1 See Glossary for all abbreviations and acronyms.

2 All times are MST (Coordinated Universal Time (UTC) minus seven hours) unless otherwise stated.

3 Units are consistent with official manuals, documents, reports, and instructions used by or issued to the crew.

...engineer witnessed this, and, realizing the potential danger of the knapsack contacting the fuel flow control lever, he left his seat to assist. It was while he was assisting the patient with the knapsack that the low rotor rpm warning horn sounded and the engine lost all power. The engineer surmised that the fuel flow control lever had inadvertently been moved, and he quickly repositioned it to the full forward (emergency) position. The engine did not regain power. The engineer immediately returned to his seat, but was unable to refasten his seat-belt prior to ground impact.

The helicopter landed heavily, collapsed the skid gear, skidded about 176 feet, rolled onto its left side, and turned about 125 degrees to the right before coming to rest. The occupants were not injured.

The helicopter struck terrain at latitude 55·45'N and longitude 115·48'W, at 1900 mountain standard time (MST)2 during the hours of daylight, at an elevation of 2,350 feet above sea level (asl)3.

1.2 Injuries to Persons

	Crew	Passengers	Others	Total
Fatal	-	-	-	-
Serious	-	-	-	-
Minor/None	1	2	-	3
Total	1	2	-	3

1.3 Damage to Aircraft

The helicopter was substantially damaged.

1.4 Other Damage

There was no other damage.

1.5 Personnel Information

Pilot-in-Command

Age - 40
Pilot Licence - Commercial
Medical Expiry - Date01 Sept 1994
Total Flying Time - 1,900 hr
Total on Type - 80 hr
Total Last 90 Days - 80 hr
Total on Type Last 90 Days - 80 hr
Hours on Duty Prior to Occurrence - 11.5 hr
Hours off Duty Prior to Work Period - 10.5 hr

1.5.1 The Pilot

The pilot was certified and qualified for the flight in accordance with existing regulations. The pilot had been recently checked out on, and completed a Pilot Proficiency Check (PPC) on, the AS350B type helicopter. During the check-out, he had carried out several successful "full on" autorotations.

1.6 Aircraft Information

Particulars
Manufacturer - Aerospatiale
Type - S350B
Year of Manufacture - 1981
Serial Number - 1440
Certificate of Airworthiness (Flight Permit) - Valid
Total Airframe Time - 3,308.2 hours
Engine Type (number of) Turbomeca Arriel 1B - (1)
Propeller/Rotor TypeSemi Articulated Single (number of) Rotor - (3)
Maximum Allowable Take-off Weight - 4,300 pounds
Recommended Fuel Type(s) - Jet B
Fuel Type Used - Jet B

1.6.1 Additional Helicopter Information

The helicopter was certified, equipped, and maintained in accordance with existing regulations and approved procedures.

1.6.2 Helicopter Control Quadrant

The control quadrant is located on the cockpit/cabin floor, adjacent to the pilot's seat. It consists of a rotor brake control, a fuel flow control lever, a start switch, and a fuel shut-off control lever. (See Figure 1.)

The fuel flow control is a flexible control lever located inside a three-position, two-gate slot. The three positions are: "closed," "flight" (or "open"), and "emergency." The full aft or "closed" position shuts off the fuel to the engine; the centre or "flight" position is utilized for normal engine operation; the full forward or "emergency" position supplies fuel to the engine under emergency conditions.

The fuel flow control lever is biased to the left and drops into one of the two "gates." To change the fuel flow control lever position, the lever must be physically moved to the right, to escape the "gate" position that it is in, before it can be moved in either a fore or aft direction. The effort required to physically move this lever to the right is minimal.

1.7 Meteorological Information

The weather conditions as reported by the pilot were as follows: clear skies, with the wind out of the west at 10 knots, a surface temperature of plus 2 degrees Celsius, and visibility of over 15 miles. Daylight conditions prevailed, and the weather was not considered to be a factor in the occurrence.

1.8 The Stretcher Installation

The stretcher was placed on the left side of the cabin floor, in a fore and aft position, with the patient's head placed towards the rear of the helicopter. The stretcher was secured by the left front seat-belt of the helicopter. The patient was secured to the stretcher by two safety straps provided with the

stretcher.

1.9 Wreckage and Impact Information

The helicopter was descending at a 37-degree angle, in a nose-high attitude, on a magnetic heading of 255 degrees magnetic, when it struck three 30-foot trees. It then travelled another 60 feet before the tail rotor struck the frozen ground. Thirty-six feet farther along, the skid gear struck the ground and was torn off. After bouncing/sliding a further 35 feet, a large section of the tail boom, vertical fin, and tail rotor assembly was torn off. The helicopter continued a further 45 feet, where it came to rest on its left side, on a magnetic heading of 020 degrees. Numerous small pieces of debris were scattered along the wreckage trail. The cargo hook had penetrated the fuel cell, but there was no noticeable fuel leakage.

The only clearing available was of ample size, but surrounded by high trees. The surface of the clearing was rough, undulating, and unsuitable for a "run on" type landing. The pilot was faced with the decision to autorotate and land in the high trees or to make a "run on" autorotation and landing in the clearing.

2.0 Analysis

2.1 Introduction

The helicopter was airworthy prior to impact, and the weather was not considered a factor. The pilot had recently demonstrated that he was competent in autorotations in the AS350B helicopter. Therefore, the analysis will focus on the human and environmental aspects to determine why this accident occurred.

2.2 The Inadvertent Movement of the Fuel Flow Control Lever

When a stretcher patient is carried in the Aerospatiale AS350B helicopter, the patient's right knee is close to the fuel flow control lever. The engineer, realizing the potential hazard of bumping the fuel flow control lever, was assisting the patient with the knapsack when the engine lost all power. It could not be determined who inadvertently moved the fuel flow control lever towards the "closed" position. This action caused fuel starvation to the engine and resulted in a total loss of engine power and a low rotor rpm.

2.3 The Autorotation

Although the size of the clearing available was suitable for an autorotation, the uneven surface was not suitable for a "run on" type landing. When the pilot was faced with the decision to land in the high trees, he made the decision to do a "run on" autorotation landing in the only clearing available. The nose-high attitude of the helicopter when it struck the ground and the relatively long wreckage trail suggest that the pilot attempted to reduce the airspeed and possibly regain some rotor rpm prior to levelling the helicopter for the landing. The low rotor rpm, which was not recovered prior to ground impact, resulted in a high rate of descent. The combination of low altitude, low rotor rpm, relatively high groundspeed at impact, and the uneven terrain resulted in an autorotation with damage to the helicopter.

3.0 Conclusions

3.1 Findings

1. The fuel flow control lever was accidentally moved out of the "flight" position, resulting in fuel starvation to the engine and a subsequent loss of all power.
2. The fuel flow lever is not guarded or protected against inadvertent movement.
3. The fuel flow control lever can be moved out of the "flight" position easily.
4. The combination of low altitude, low rotor rpm, high groundspeed at impact, and uneven terrain resulted in an autorotation with substantial damage to the helicopter.
5. The pilot was certified, trained, and qualified for the flight in accordance with existing regulations.
6. The aircraft was certified, equipped, and maintained in accordance with existing regulations and approved procedures.

3.2 Causes

The floor-mounted fuel flow control lever was inadvertently moved to the closed position, resulting in fuel starvation to the engine, a total loss of engine power, and low rotor rpm.

4.0 Safety Action

4.1 Action Taken

On 22 September 1994, the TSB forwarded an Aviation Safety Information letter to Transport Canada (TC) regarding the possibility of inadvertent manipulation of the fuel control lever on the AS350B helicopter. TC and industry are investigating the feasibility of installing a control quadrant guard to reduce the likelihood of inadvertent fuel control lever movement.

This report concludes the Transportation Safety Board's investigation into this occurrence. Consequently, the Board, consisting of Chairperson, John W. Stants, and members Gerald E. Bennett, Zita Brunet, the

Hon. Wilfred R. DuPont and Hugh MacNeil, authorized the release of this report on 17 February 1995.

Appendix A - Glossary

agl - above ground level
asl - above sea level
hr - hour(s)
lb - pound(s)
MST - mountain standard time
nm - nautical miles
PPC - pilot proficiency check
TC - Transport Canada
TSB - Transportation Safety Board of Canada
UTC - Coordinated Universal Time
' minute(s)
· degree(s)
N north
W west
NE northeast

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